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*Proof.* $BC=AB$ and $BH=AH$ by construction.

$\angle HBA=\angle BAC+\angle ACA=2\angle BAC$. But $\angle HBA=\angle HAB$.

$\therefore\quad \angle HAC=\angle HAB+\angle BAC=3\angle BAC$.

Within reasonable limits of length of the rules $FC$ and $AD$, angles up to 120° can be trisected.

*History.* Last February four years ago, I was experimenting with triangles. I had drawn a rt.△ whose acute angles were 60° and 30°. By joining the vertex of the rt.∠ with the middle of the hypothenuse, I noticed that the rt.∠ was trisected. To devise an instrument for the trisection of any angle then engaged my mind for a few weeks, and the above device was the result.

I communicated my discovery to several mathematicians and inquired as to its practicability. The replies were not encouraging. One reason given was that an instrument with several joints and a slide, was not sufficiently accurate. The suggestion was also made that it would not pay to get it patented, as the trisecting of angles entered to a very limited extent in the mechanical applications.

Thinking that the readers of the AMERICAN MATHEMATICAL MONTHLY might be interested in this device, though it may be but a mathematical curiosity, I have given the foregoing brief sketch of it.

* * *

# DIAGRAM FOR THE LAWS OF THE FALLING BODIES.

By Rev. A. L. GRIDLEY, Pastor of the Congregational Church, Kidder, Missouri.

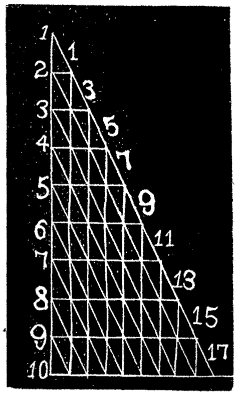
Let the distance a body would fall in one second be represented by one of the small triangles in diagram as $a$. During the first second it would fall through the firstspace, or triangle at the apex. During the second second it would pass through three, as that is the number of triangles in the second space which is indicated by the figures at the right. During the two second it would pass through 3+1 triangles$=4a$, or $2^2\times a$.

To illustrate farther. How far would a body fall during the 9thsecond of its descent?

Opposite the figure 9 on the left are 17 triangles so it would pass through 17 times the distance it did during the first second or $17a$. How far would it fall during the ninth second without increment?

Leave off the right hand triangle and there would remain 18 so it would fall $18a$.

What would be the velocity at, say, the end of the 8th second? It would be the distance it would fall during the 9th second without increment, or the triangle at right hand side,$=16a$.



How far would it fall in, say, 9 seconds. Of course $9^2 a$ or the sum of all the triangles in the first nine spaces.

With what velocity must a body be projected upward in order to rise during 10 seconds? Opposite 10 are 19 triangels so the initial velocity should be $19a$.

By a little thought any rule or problem in falling bodies can be *counted* out upon the diagram and it is unnecessary to commit any rule to memory as it can be produced at any moment from the diagram. Even the recollection will usually be sufficient to solve an ordinary problem as it has done with the inventor of the diagram—the writer—for thirty-five or forty years.

ERRATUM.—Owing to the extravagance of the compositor a needless *the* was inserted in the title of this paper.—PUBLISHERS.

* * *

# ARITHMETIC.

**Conducted by B.F.FINKEL, Kidder, Missouri. All Contributions to this department should be sent to him.**

## SOLUTIONS OF PROBLEMS.

**38. Proposed by J. A. CALDERHEAD, B. Sc., Superintendent of Schools, Limaville, Ohio.**

What must be the thickness of a 36-inch shell, in order that it may weigh 1 ton, supposing a 13-inch shell to weigh 200 pounds, when two inches thick.

### IV. Solution by the PROPOSER.

$$200:2000::13^3-9^3:36^3-r^3;\text{ whence } r=31.74\text{ inches.}$$

$$\therefore\quad (36-31.74)\div2=2.13\text{ inches}=\text{thickness of 36-inch shell.}$$

**39. Proposed by P. C. CULLEN, Superintendent of Schools, Brady, Nebraska.**

$A$, $B$, and $C$ start from same point at same time. $A$ north at rate of three miles per hour, $B$ east at rate of four miles and $C$ west at rate of five miles per hour. $B$ at end of two hours starts at such an angle as to intersect $A$. How long after starting must $C$ start north-west in order to meet $A$ and $B$ at common point?

### II. Solution by Professor H. W. DRAUGHON, Olio, Mississippi.

While $B$ travels 8 miles east, $A$ travels 6 miles north. The rest of $A$'s distance north, and the distance $B$ travels after turning, are in the ratio of 3 to 4. Since $B$'s latter distance is on the hypothenuse of a right triangle, whose base is 8 miles and perpendicular, $A$'s distance, we have from Geometry, (hypothenuse+8)(hypothenuse−8)$=(\frac{3}{4}$hypothenuse$+6)^2=\frac{9}{16}$(hypothenuse$+8)^2$; whence, by division, we get hypothenuse$-8=\frac{9}{16}$(hypothenuse+8). $\therefore$ hypothenuse$=28\frac{4}{7}$ miles; and the perpendicular, $=A$'s distance north,